

# Sustainability and Energy

## The role of Chemistry

*Luigi Campanella*

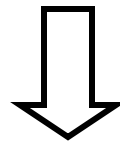
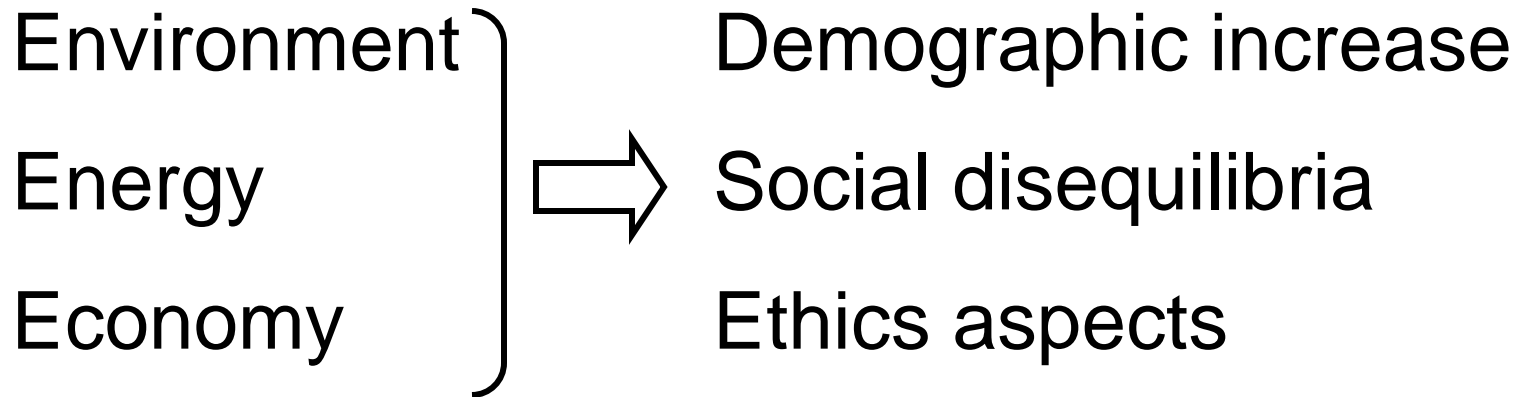
*President of Italian Chemical Society*

DIPARTIMENTO DI CHIMICA



SAPIENZA  
UNIVERSITÀ DI ROMA

# The worldwide crisis

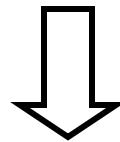


Economical costs and Ecological costs  
(different scales)

# Direct and Undirect Saving of Energy

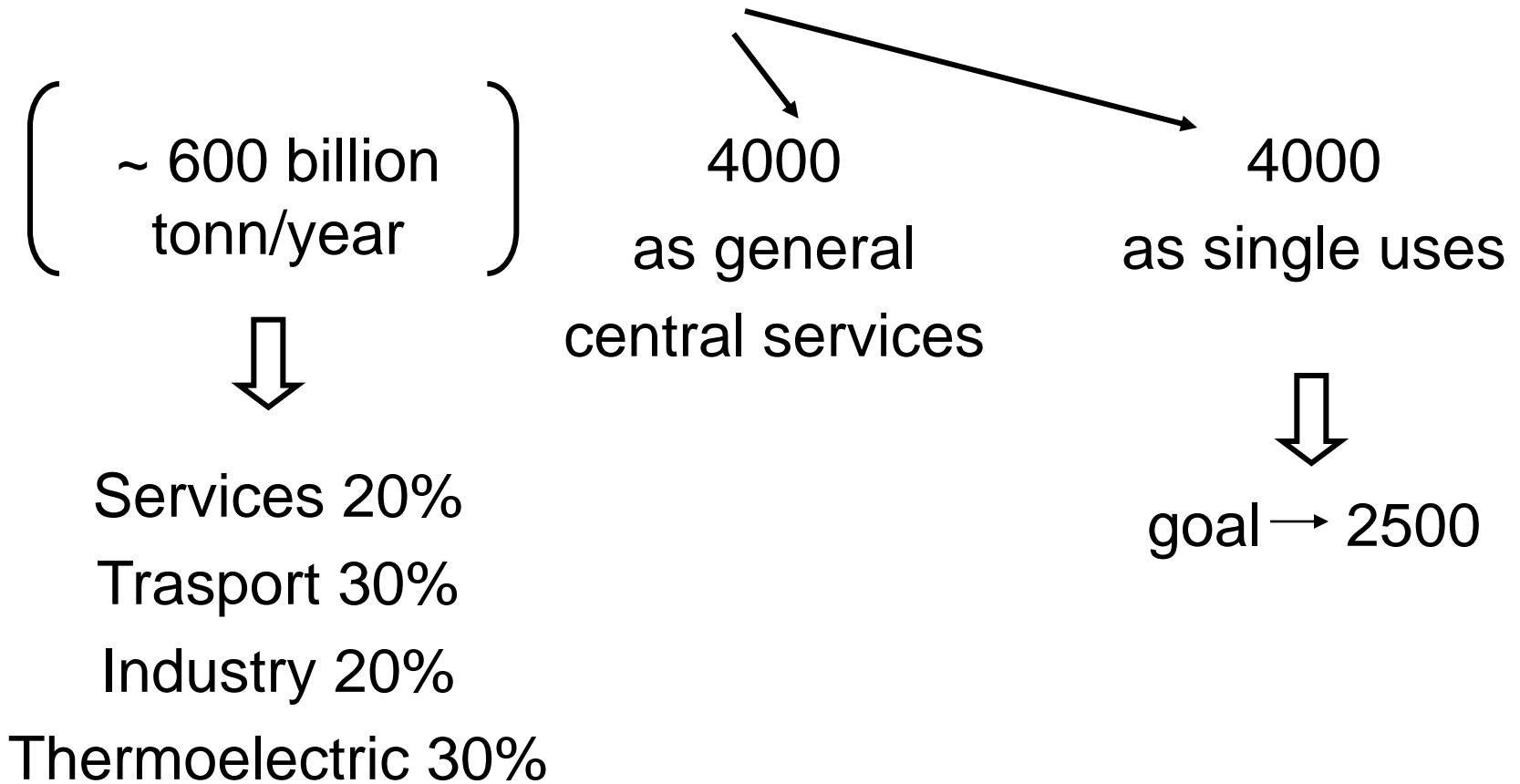
Ecological Footprint: statistical index relating human consumption of natural resources (food, energy) to the capacity of soil to be regenerated:

41500 square meters for each citizen in Italy



8 “Italies” should be needed

# CO<sub>2</sub> 8000 Kg/year for citizen in Italy



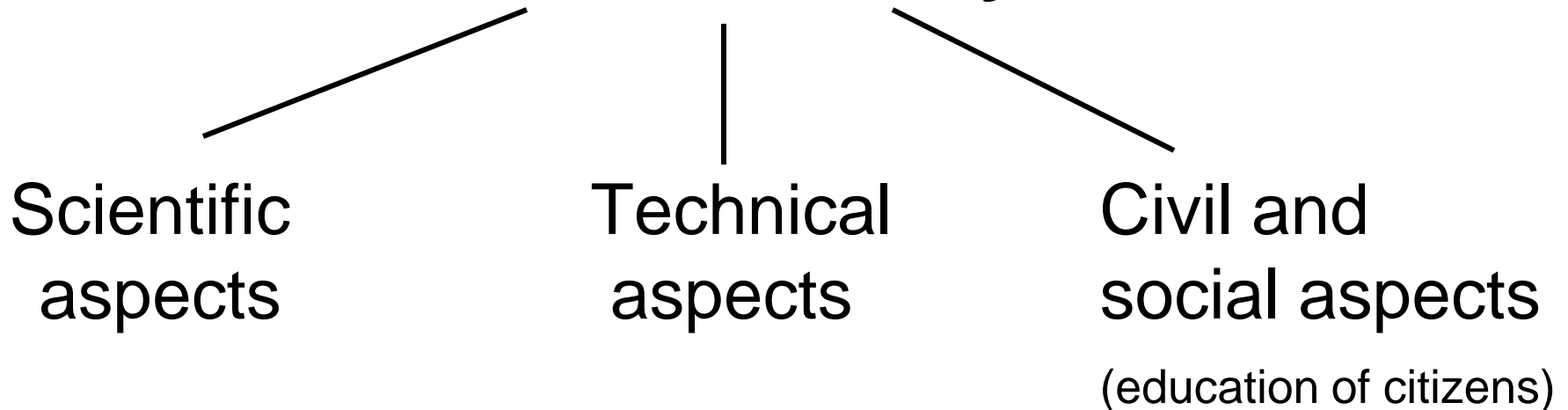
## Savings in terms of Kg of CO<sub>2</sub>

intelligent taps	- 470 Kg
TV standby	- 8
Washer and Freezer Machines	- 80
Ecolamps	- 35
Recycle of cans	- 20
Use of paper sheets on double faces	- 85
Eco Trasport (car sharing, cyclable runs)	- 350
Virtuous cars	- 250

# Italian Chemical Society

Project:

## Zero Emission City as Lab



Integrated system

# Which city will be the first one at zero emissions?



Competition



Copenhagen



50 directives



2020

structures

urban transport

Vancouver (2030)

Ecodensity Chart  
(limits to respected)



Leed Certificate

(Leadership in Energy and Environment)



Stockolm

Zurigh

New ecological cities

China

Arab Emirates

# Bolzano in Italy

Limit of CO<sub>2</sub> emissions  
even by compensation approach



Energy efficiency and thermal  
Insulation of Buildings

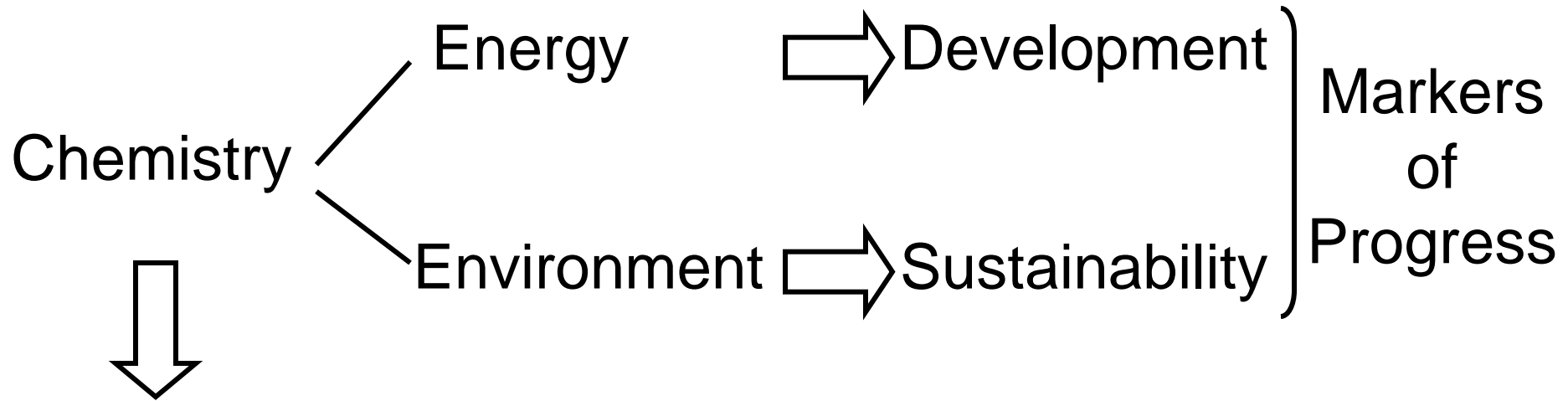
Different Degrees of Houses (B, A, Gold)

Central Heating

Movement by cycles

# **Civil uses of Energy**

## **Urban Transport**



# Climate Change

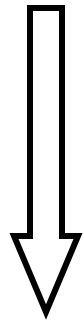
## Greenhouse effect

Chemical aspects: photosynthetic enzymatic inhibition  
natural photodegradation (enthalpy?)  
soil activity  
effect of water on heating by irradiation  
melting of ices  $\Rightarrow$  dilution effects  
lignin/cellulose ratio

# ECOCEMENT



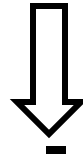
Cement added with  $\text{TiO}_2$



$h\nu$

Degradation of urban pollutants

# Economy of CO<sub>2</sub>



adsorbed

produced

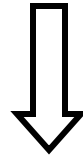
(Renewable fuels, woods, cellulose, biomass)



## Sequestering of carbon

$\text{H}_2\text{O} + \text{CO}_2 \rightleftharpoons$  Storage of great amounts of  
CO<sub>2</sub> in geological systems  
pressure to extract fuel gas

# **Atomic Economy in Industrial Process**



**Decrease of waste and residue amounts**



# Energy from Biomass

- 1) biochemical process
- 2) thermal process

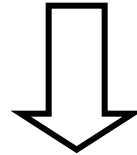
# Chemistry



Optimization of the energy production procedures (materials, reagents, processes)

Energy form as capacity to perform or to be based on a work able to produce a change of state or of composition in a system (living or not)

# Energy from Condensed Matter



- 1) Chemical State of the raw material
- 2) Chemical State of electrochemical interphase